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**D02427**

Distr.  
LIMITED  
ID/WG.76/18  
30 November 1970  
ORIGINAL: ENGLISH

United Nations Industrial Development Organization

Working Group Meeting on Economics of Scale  
in the Latin American Automotive Industry ✓  
Santiago, Chile, 21-30 September 1970

CASE STUDY OF THE MANUFACTURE OF ELECTRICAL EQUIPMENT  
IN THE ANDEAN AREA 2/

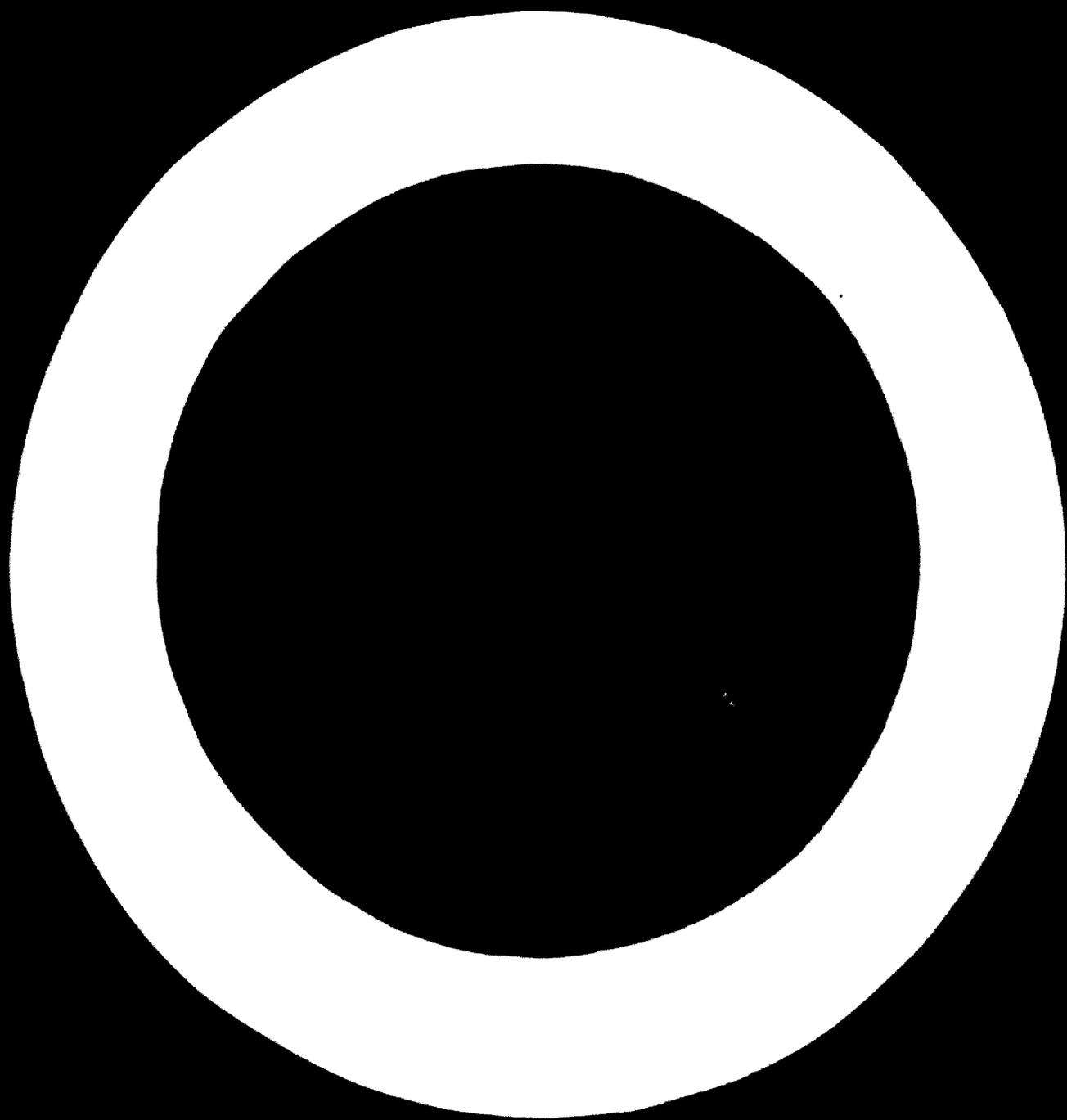
presented by

FABRICA ELECTRO MECANICA S.A.  
- FEMSACO -

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id.70-6610

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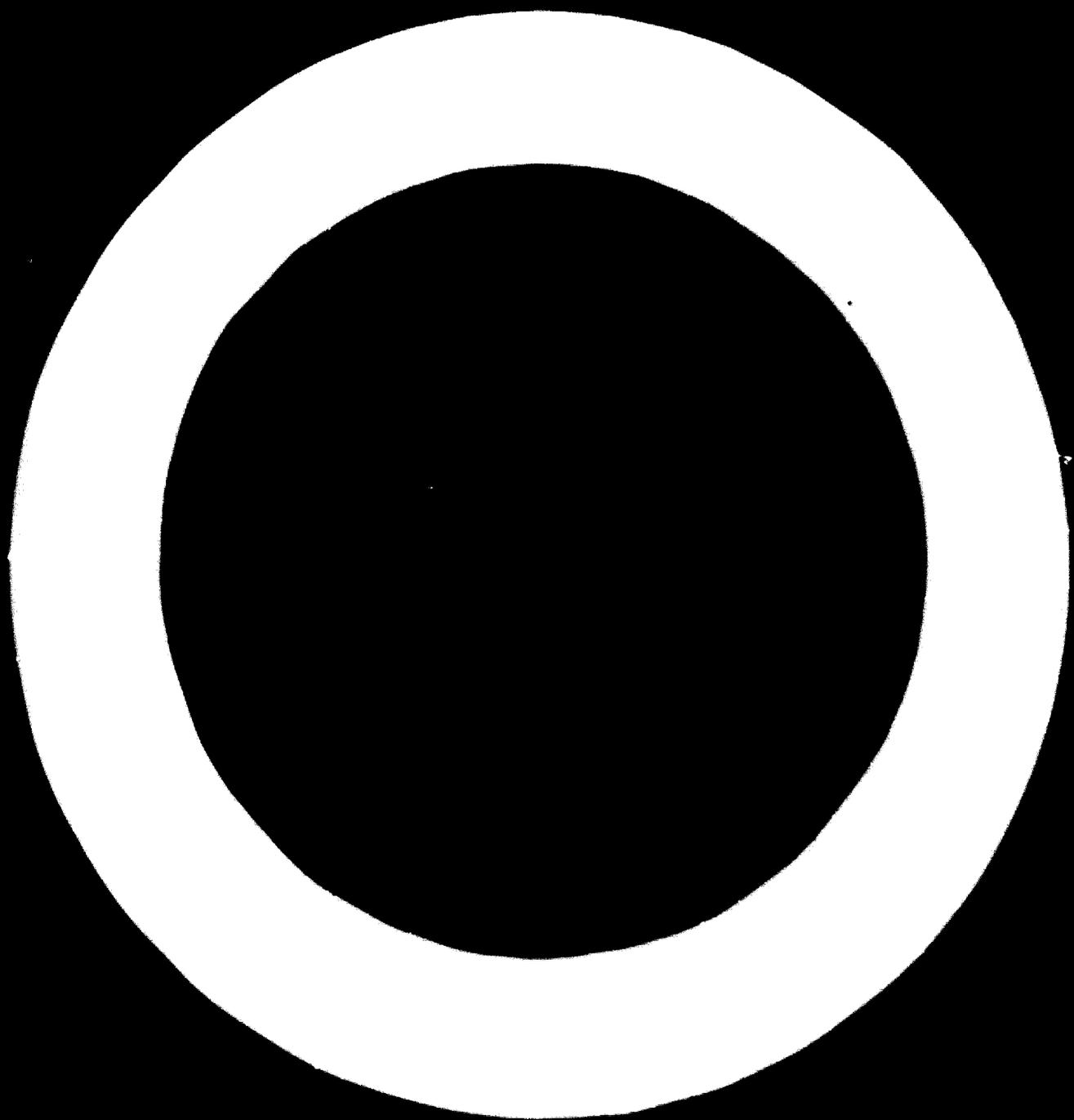


MANUFACTURE OF CAR ELECTRICAL EQUIPMENT IN THE  
ANDEAN AREA

Electrical components on which this study is based

- Starter motor
- Generators: alternators  
                  dynamos
- Voltage regulators
- Distributors
- Ignition coils
- Horns
- Windshield wipers
- Heater motors
- Relays
- Switches
- Signals

**/THE MANUFACTURE**



THE MANUFACTURE OF CAR ELECTRICAL EQUIPMENT  
IN THE ANDEAN AREA

FABRICA ELECTRO MECANICA S.A. (FEMSA) is a company based in Chile, part of whose capital belongs to FABRICA ESPAÑOLA MAGNETOS S.A. (FEISA), a Spanish company that has developed into a multinational enterprise, devoted exclusively to the manufacture of electrical equipment for vehicles. The patents, technical assistance and licences of the Spanish firm constitute the technical basis of the development of our company in Chile.

Sister companies in Latin America already exist in Venezuela, are under construction in Colombia and other countries; their aims are similar to those of FEMSA in Chile.

The basic guidelines followed by FEMSA in setting up new companies, particularly in the countries of the Andean Agreement, are as follows:

1. The countries want vehicles, and so they buy or manufacture them; in particular, the developing countries want the car industry to act as a catalyst to industry as a whole, through its direct and indirect effects. For this reason, the stages of integration of national parts are normally speeded up, to a greater or lesser extent, according to the circumstances of the case.
2. The availability of foreign exchange, or rather the balance-of-payments imbalances strengthen the determination of the countries to go in for car manufacture, seeking to achieve two basic objectives which are contradictory owing to the restricted size of the market in which they arise:

- Highest possible local content;
- Minimum cost.

The following remarks should be made in respect of the above-mentioned conditions:

The car industry in general, and the Chilean industry in particular, require high levels of technology and huge capital investment at an international level.

/Similarly, this

Similarly, this type of industry generates large costs, owing to the high level of investments to be made, the high level of specialization of the staff and the increase in general expenditure.

If the points mentioned above are to be incorporated in mass production plans within the limited context of each country, a compromise will be made between the conditions of minimum cost and maximum local content.

From the above the following conclusions may be drawn:

Without any doubt the ideal solution is for each country to specialise in the production of a group of goods in the manner best suited to the economy of the area as a whole and the relative position of each country within that area.

Thus, with regard to an industry such as our own, we consider that, in the Andean countries at least, Chile is the country best suited to its development. The basis for this argument lies in the fact that Chile is a copper and steel-producing country - basic inputs in this branch of the automotive industry - and in the existence of qualified labour for training in the techniques involved in the manufacture of electrical equipment.

The achievement of the above will obviously be confined within certain practical limits according to the economic situation and achievements of the countries; but we believe that an attempt should be made to arrive at a situation, identical, as far as possible, with that outlined above, bearing in mind that the enterprises should be permitted to achieve the highest degree of efficiency in respect of local content and low costs, taking full advantage of the practical prospects in each country.

In our own case, in view of the apparent impracticability of the ideal solution of a single factory producing electrical equipment for the whole Andean Area - since several countries would like to have at least a share in that industry - we can offer a viable alternative which would give a practical means of fulfilling the conditions already established.

/Thus, in

This, in each of three countries, we propose to establish a factory specializing in various types of apparatus within the full range of electrical equipment (accounting for about 3.5 per cent of the cost of the vehicle), so that through exchange with the other countries of the area, a system may be established whereby, in general, what each country produces for its local industry is a small fraction of its total production, the remainder being destined to the other countries of the area.

Similarly, the whole operation in each country must be carried out against a background of a more or less neutral balance-of-payments position.

Proceeding in this fashion, it would be possible to achieve a high degree of nationalization and low costs, since production would cover total demand in the area.

Moreover, there should not be an excessive number of factories since it is aimed to carry out a minimum of investment in certain structures which would be repeated.

To harmonize the above operation, the following principles must be combined:

1. Drawing up a policy enabling the above to be carried out, it being especially important that each country recognize as national content all that it receives under exchange programmes within each category of specialisation.
2. The exchanges have to be duty-free since the country will obtain its profits from the creation of intensive-capital, consolidated industries, generating a large amount of value added, industries that would work at costs which might permit their projection to other markets.
3. Harmonization of fiscal and industrial legislation and of the costs of materials, so that the final costs may be equivalent.
4. Obliging a high degree of nationalization in the manufacture of the vehicles that make up the demand of the area.
5. Creation of a general policy of promotion of investment to ensure high productivity where important technological innovations are involved.

/Sample industrial.

Sample industrial projection for the FEMSA Group of companies, proposed  
for the Andean Subregion

The year 1975 is taken as the base year.

The demand on which this work is based will be that laid down in the ECLA Information Document N° 1 (The demand for motor-vehicles in Latin America) which gives figures that more or less coincide with our estimates.

Estimated demand for vehicles in 1975.

- Colombia	26,100 vehicles
- Chile	29,000 vehicles
- Peru	30,000 vehicles
- Ecuador and Bolivia	10,000 vehicles
Total estimated demand in the area:	95,000 vehicles

Assuming that total electrical equipment (that is, starter motors, generators, voltage regulators, ignition coils, distributors, horns, relays, accessories, windshield wipers, and heater motors) were divided among three plants with an equivalence of material and technological values, the situation could be as follows:

First country specializing in the production of starter motors and ignition coils.

Second country specializing in the production of generators (alternators, dynamos) and regulators.

Third country specializing in the production of distributors, windshield wipers, heaters, accessories and relays.

Each of these groups of electrical equipment for each country is equivalent to 1.2 per cent of the cost of the vehicle.

A plan of this type to supply the whole area would involve the following amounts of fixed investment, in rough figures, for each country:

/Machinery, tools

Machinery, tools	US\$ 1,000,000
Factory buildings, plant	US\$ 500,000
Total investment in each country	US\$ 1,500,000
Total investment in the whole area	US\$ 4,500,000

The investment provided for comprises the following requirements:

1. Machinery incorporating the latest technological advances.
2. A doubling of production does not require investment of more than 25 per cent of that already indicated, so that it would be easy to project the operation of these plants outside the region. Our plant in Chile already conducts business outside the Andean area.
3. Complete flexibility is required for operations between these plants, so that the countries at all times maintain the desired equilibrium in their exchanges.
4. For the proper development of a plan of this type, bearing in mind that the electrical equipment of a vehicle is a set of interrelated apparatus, it is essential:
  - 4.1 That the equipment, or rather the apparatus produced in each country should belong to a unique set of equipment, developed and projected by an international firm, which permits:
    - homologation of the vehicle manufacturers;
    - procurement of adequate technical assistance services in each country, as the individual firms become responsible not only for the products that they manufacture but also for those that they exchange with their sister companies.
  - 4.2 Concentration of this type would make it possible to create a model industry in respect of its capacity to adopt and develop techniques that involve improvements capable of benefiting the other industries of those countries.

The Spanish firm of FEMSA, when it was first established in Chile, planned to manufacture all electrical equipment in the country, and planned the following levels of investment, more than half of which has already been carried out:

/Total investment

Total investment of US\$ 3,028,000, of which machinery and tools account for only US\$ 1,906,000; to the first figure should be added cash investments by local partners and local sources of finance.

If the countries of the region are not able to co-ordinate their policy in respect of these enterprises, and a repetition of more or less the same amount of investment is required, in every country, this would mean an excess of investment, which would have very adverse effects on production costs.

Similarly, small-scale production of all the articles of equipment prevents the proper training of labour, which is finally reflected in the levels of productivity and their consequent incidence in costs.

We shall now attempt to evaluate the advantage to be gained from co-ordinating a policy such as the one we propose of three plants in three countries carrying out operations for the area as a whole, as compared with the situation of a plant producing the full range of equipment in each country, whose operations would be limited to the market of its own country.

We shall be dealing with equipment in the group relating to the first country: starter motors and ignition coils.

Let us take the case of a national market where there is a demand for 30,000 vehicles.

Assuming a market of 30,000 vehicles in a single country, production of starters and ignition coils would be of the following order:

- Starters	31,000
- Ignition coils	40,000

This scale of production gives reasonable leeway for the existence of a stock for repairs and eventual replacement.

We have also accepted that the groups mentioned on pages 9-10 account for 1.2 per cent of the cost of the vehicle, so that on analyzing one of these groups we are covering all the hypothetical manufacturers.

The values we have mentioned are by way of examples and in no way exact, but they are fairly realistic.

/We shall

We shall begin our case with an analysis of the incidence of certain factors on cost, on the market of each individual country (30,000 vehicles), assuming that each country manufactures the full range of electrical equipment.

For the manufacture of starter motors and ignition coils we should have the following picture:

Approximate investment of:

(1) US\$ 800,000 for machinery and tools, which can be broken down roughly as follows:

US\$ 700,000 for machinery and US\$ 100,000 for tools. That is, we suppose that the value of machinery and tools is less than in the case of a single specialized factory needing equipment which is common in this field.

For machinery we shall suppose a useful life of ten years and a lineal amortization of US\$ 70,000 a year; for tools we shall assume a useful life of three years, which would imply an amortization figure of US\$ 33,000 if we operate on the same basis as with machinery.

In respect of the apparatus already referred to (starters and ignition coils), the combined amortization of tools and machinery will amount to US\$ 103,300.

(11) We have estimated an investment of US\$ 1,000,000 in construction and related works for a factory producing complete sets of electrical equipment, with a capacity of 40,000 sets a year.

In line with the arbitrary division of electrical equipment we have made, we shall assign one third of this investment to the apparatus dealt with here, that is, starters and coils.

For this investment we shall suppose a useful life of twenty-five years, which would give us an annual amortization of 4 per cent, if we accept lineal amortization once again.

This 4 per cent amortization in respect of all electrical equipment would give a figure of US\$ 40,000 a year, a third of which (US\$ 13,300) would correspond to the starters and coils already mentioned.

/For the

For the further breakdown of these figures we shall assume that one starter is equivalent to eight coils in all respects.

On the basis of the above values the annual amortisation for starters would be around US\$ 116,600 a year.

This figure broken down between starters and coils, on the ratio of 1:8 mentioned above, would give the following values:

US\$ 103,000 for 31,000 starter motors

US\$ 12,960 for 40,000 ignition coils

These values considered in respect of each unit of apparatus would give figures of:

US\$ 3,343 for amortization of machinery, tools, building and plant for each starter motor;

US\$ 0,324 for amortization of machinery, tools, building and plant for each ignition coil.

Considering solely amortization on the above-mentioned assets, these figures would amount to roughly rather more than 20 per cent of the European sales prices for this apparatus.

These amounts would be sharply reduced in the case of specialized production for selected countries with a market throughout the area, since in the case we have already put forward we should have an estimated market of 120,000 coils and 90,000 starters which, on the basis of the above analysis, would call for the following investment:

(1) US\$ 1,000,000 for machinery and tools, made up of US\$ 850,000 to be covered in ten years and US\$ 150,000 for tools with a life-span of three years.

On the basis of these estimates we may arrive at the following figures.

US\$ 85,000 - annual amortization on machinery.

US\$ 50,000 - annual amortization on tools.

Adding together these two figures we have US\$ 135,000 to be divided between starters and coils produced in one country and destined to the whole area.

/(11) Investment



### Analysis of productivity

In the case of a plant manufacturing the full range of equipment for the restricted market of each individual country, there is the obvious problem that the production lines that meet world technical standards and requirements are working well below their capacity, which in the first instance generates wasted machine/hours, and at the same time obliges the staff to diversify their activities in other branches of production; while preventing staff inactivity, this phenomenon militates against the efficiency of the production process.

Thus, in the case of the ignition coil, if the capacity of the production line is increased from 50 to 100 per cent, there is a 50 per cent saving in the average time for the production of each coil. Similarly, specialization permits the introduction of bonus payments on production which is ultimately reflected in greater real income for the workers and higher output.

### Raw materials

The situation of the current high waste of basic inputs can obviously be improved by specializing in specific products in larger amounts.

For instance, for the production of 40,000 ignition coils in one year, 7,020 kg. of copper wire would be required, which gives an average monthly consumption of 585 kg.; if production were to cover area demand (120,000 units) the monthly consumption of copper wire would rise to 1,755 kg., with an annual consumption 21,060 kg. These figures are already fairly high and enable the supplier to properly plan his production.

### Standardization of FEMSA electrical equipment

FEMSA started its manufacturing activities with a clear idea of the possible advantages of correct and rational standardization.

/FEMSA designed

FEMSA designed different types of electrical equipment which were homologated by its clients: FIAT, RENAULT, GENERAL MOTORS, FORD, BRITISH LEYLAND, CITROEN, PEUGEOT, NISSAN, PEGASO and CHRYSLER.

A practical example is provided by starter motors, for which there are four basic types to cover the whole range of passenger and commercial vehicles. Moreover, many of the parts for these motors are common to the different types.

Thus, FEMSA today supplies 99 per cent of the original electrical equipment for the Spanish market (more than 1,800 vehicles a day), and a high proportion of equipment for the Chilean, Portuguese and Venezuelan markets.

In order to cover practically all the needs of the car manufacturers for electrical equipment of the correct quality and at reasonable prices in the market of the Andean subregion, we consider that it would be necessary:

- To manufacture electrical equipment standardized as far as possible on the basis of a minimum of types.
- Considering that the Andean market cannot be compared, for instance, to the European, North American or Japanese markets, to limit plant to:
  - A single factory manufacturing electrical equipment for the whole subregion;
  - A maximum of two or three factories in the area, each specializing in different types of apparatus within the complete range.

Comparison between possible unit cost in a factory producing the full range of equipment for the market of a single country (demand of 30,000 vehicles) and in factories specializing in different types of apparatus for the market of the whole Andean subregion.

/Factory producing

100	Factory producing the full range of equipment for a single country (market 30,000 vehicles)  A	Factories specializing in specific apparatus for the market of the whole subregion  B	
	Amortizations (4)		
	Miscellaneous (3)		
	Pay-roll (2)	Amortizations (4) Miscellaneous (3)	70
Raw materials (1)	Pay-roll (2) Raw materials (1)		

Estimates accepted:

(1) Raw materials:

A: estimated coefficient of inefficiency 2.48 international price.

B: improvements up to an inefficiency coefficient of 1.7 thanks to obtaining greater purchasing power, customs exemptions and greater competition among basic suppliers.

/A. based

(2) Pay-roll

A: based on the estimated productivity for a factory producing the whole range of equipment for a single country (over 30,000 vehicles).

B: improvement in the unit value of staff resulting from improvements due to staff specialization and increased output.

(3) Miscellaneous

: has been maintained constant in both cases.

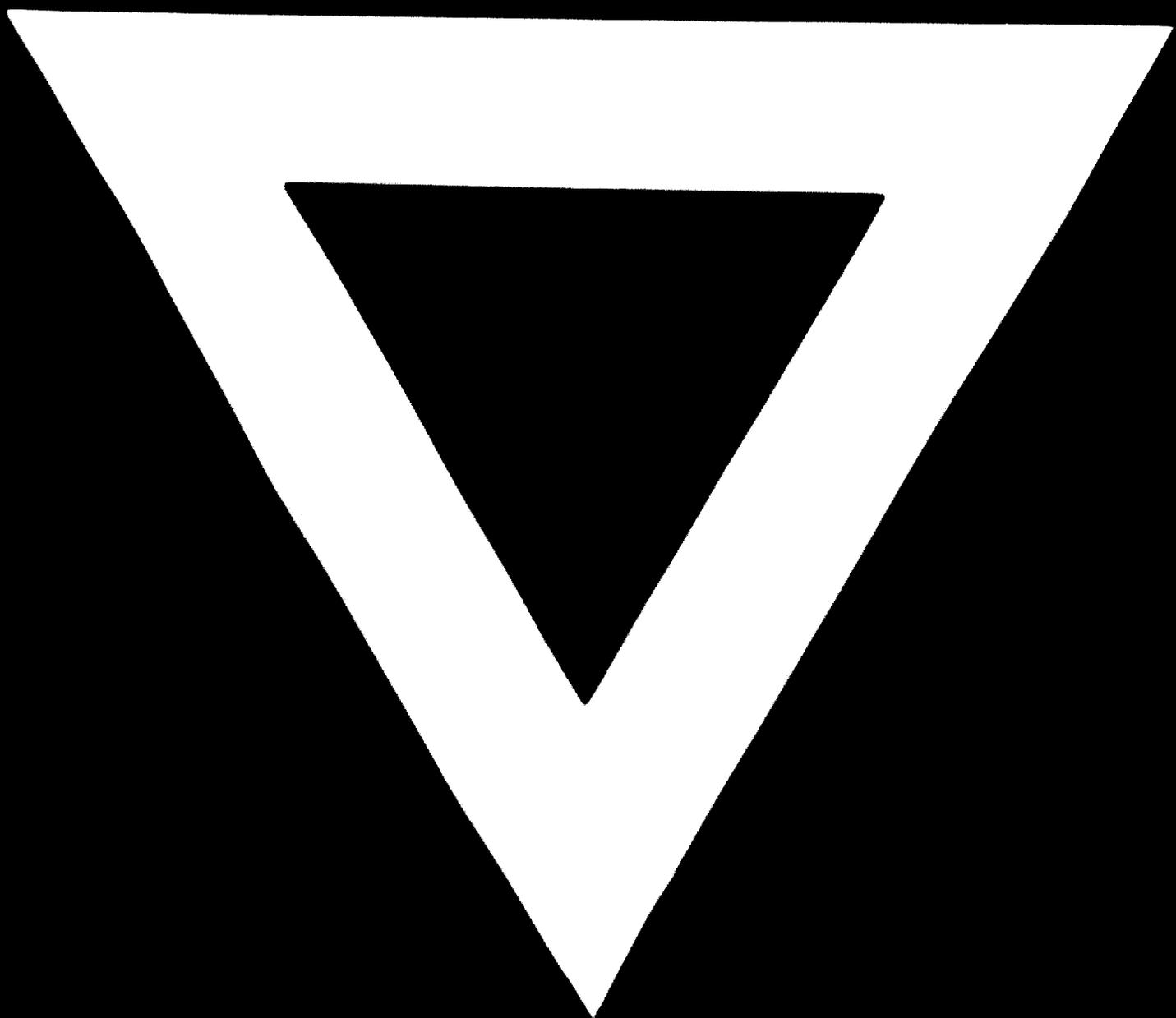
(4) Direct amortization  
(machinery, tools,  
buildings).

A: corresponds to about 12 per cent.

B: 6 per cent, as a result of the estimates made in this study.

A third example which would undoubtedly have advantages over the above two cases would be the existence of a single factory manufacturing electrical equipment for the whole area.





**26. 6. 72**